A Spectroscopic Method for Determining the Second and Third Contacts during a Total Eclipse of the Sun. By William Shackleton, A.R.C.Sc.

The spectroscopic method by which the determination of all the contacts can be made, as given by Faye and Young in 1869, although capable of giving very accurate results, requires at the same time a moderately powerful spectroscope attached to a telescope, and also a great nicety of adjustment.

For many purposes at the actual time of eclipse the second and third contacts are more important than the others, so for the benefit of eclipse observers I give the following method by which these can be determined, being the one I employed during the total eclipse of 1896 August 9 in Novaya Zemlya, requiring no larger size of instrument than can be put into one's waistcoat pocket.

If at any time the Sun be looked at through a prism, a band of continuous spectrum will be seen, but in a total eclipse of the Sun, as the Moon advances, the Sun's disc will be gradually obscured until there is only a thin crescent left; if now this crescent be examined by means of the prism with the refracting edge parallel to the line joining the horns of the crescent, it will be seen that a slit is unnecessary, for eventually the remaining portion of the Sun's photosphere becomes so thin that the Fraunhofer groups make their appearance as curved lines. (This can be seen at any time by looking at the Moon with the same apparatus when a very thin crescent.)

A very convenient form of instrument to use is a small direct vision prism; the one I employed was an ordinary Maclean eyepiece or star spectroscope (kindly lent me by General A. de Gorloff), with the cylindrical lens removed. With such a small instrument the whole of the rapidly thinning crescent can be observed at once, and at length the continuous band of spectrum begins to get narrower, and bright arcs representing the spectrum of the chromosphere, corresponding in position to H_α, D_3, H_β, and H_γ, appear protruding at either side. It is now necessary to be on the alert, for these bright arcs grow rapidly in brightness and length, while the continuous band which they can be seen to cross grows correspondingly narrower with the waning photosphere, until at last with great rapidity it thins out to nothing, which moment of disappearance marks the time of second contact.

For the determination of the third contact it is necessary to observe the reverse phenomenon, *i.e.* the appearance of the continuous spectrum, crossing at right angles and in the middle of

1897MNRAS..58...27S

their lengths the long chromospheric arcs seen near the end of totality; this point of re-appearance gives the time of third contact. Immediately preceding this, however, and in the same position, a great many short arcs parallel to the long chromospheric ones will flash in momentarily; these represent the spectrum of the reversing layer, and may be used as a warning that the photosphere will reappear within a few seconds after.

That this method is really capable of giving a fairly accurate result can be gathered from the "Preliminary Report on the

---

Ephemeris for Physical Observations of Jupiter,

Greenwich Noon	P	L—O	B	Apparent Diameter. Equat. 2a.	Apparent Diameter. Defect.	Apparent Diameter. Polar 2b.	d	w	B′
1897.	°	°	°	″	″	″	°	°	°
Dec. 10	25·114	51·782	−2·332	35·28	0·26	33·07	9·87	268·44	−2·49
12	25·096	52·029	2·348	35·47	·27	33·25	9·97	268·40	2·50
14	25·079	52·269	2·363	35·67	·27	33·43	10·06	268·36	2·52
16	25·062	52·499	2·378	35·86	·28	33·61	10·14	268·32	2·54
18	25·046	52·719	2·393	36·07	·28	33·81	10·20	268·28	2·55
20	25·030	52·930	2·408	36·28	·29	34·00	10·25	268·24	2·57
22	25·015	53·130	2·422	36·49	·29	34·20	10·30	268·20	2·58
24	25·000	53·320	2·436	36·70	·30	34·40	10·34	268·16	2·60
26	24·985	53·499	2·450	36·92	·30	34·60	10·37	268·12	2·61
28	24·971	53·668	2·464	37·13	0·30	34·81	10·38	268·08	2·63
30	24·958	53·825	2·477	37·36	0·31	35·02	10·39	268·05	2·64
1898.									
Jan. 1	24·945	53·971	2·490	37·58	·31	35·23	10·39	268·01	2·66
3	24·933	54·106	2·503	37·81	·31	35·44	10·38	267·97	2·67
5	24·922	54·229	2·516	38·04	·31	35·66	10·35	267·92	2·68
7	24·913	54·341	2·528	38·27	·31	35·87	10·31	267·88	2·70
9	24·904	54·440	2·540	38·51	·31	36·09	10·25	267·84	2·71
11	24·896	54·528	2·552	38·74	·31	36·32	10·19	267·79	2·72
13	24·889	54·603	2·564	38·97	0·30	36·54	10·12	267·74	2·73
15	24·883	54·666	2·575	39·21	·30	36·76	10·04	267·69	2·75
17	24·878	54·717	2·585	39·46	·30	36·98	9·92	267·63	2·76
19	24·875	54·755	2·595	39·70	·29	37·21	9·82	267·57	2·77
21	24·873	54·780	2·605	39·94	·29	37·44	9·69	267·51	2·78
23	24·872	54·793	2·614	40·18	·28	37·66	9·55	267·45	2·79
25	24·872	54·793	2·623	40·41	·27	37·88	9·40	267·38	2·80
27	24·872	54·780	2·632	40·65	·26	38·11	9·23	267·30	2·81
29	24·874	54·754	2·640	40·89	0·26	38·33	9·05	267·22	2·82
31	24·877	54·716	2·648	41·12	·25	38·55	8·86	267·14	2·82

© Royal Astronomical Society • Provided by the NASA Astrophysics Data System